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**Performance, Reliability and Life Issues for Components of the Planck Sorption
Cooler***

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The Jet Propulsion Laboratory (JPL) is developing continuous-duty hydrogen sorption cryocoolers for the ESA Planck mission, which will measure the anisotropy in the cosmic microwave background. In order to achieve an acceptable level of performance and robust operation of these hydride refrigerators during flight, detailed investigations have been performed on the sorbent materials and on critical hardware components. Summaries of experimental results obtained for the various mechanical components, the hydride selected for the compressors, and the hydride used for actuators for gas gap thermal switches are reported. Critical mechanical components include check valves that isolate the high and the low-pressure sides within the sorption compressor and are potential single-point failures as internal leaks would short circuit hydrogen flow to the J-T expander. Check valves were operated using hydrogen gas for over 40,000 pressure cycles at various orientations and temperatures without leaks or other changes. All the filters that will be used to protect check valves and Joule-Thomson (J-T) expander from particles were tested, as were the J-T and the liquid storage reservoirs. The temperature gradients along the tubular heater elements for the compressor beds were evaluated to assess their impact on the dynamics of compressor element heating and hydrogen desorption. The durability and reliability of low-power heaters used for the gas gap actuators were determined by accelerated temperature cycling. The sorbent longevity has been verified for both the compressor alloy and the gas gap actuator alloy.

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